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10/604,907	08/26/2003	Huajie Chen	FIS920030253US1	1906
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INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533			LEWIS, MONICA	
			ART UNIT	PAPER NUMBER
			2822	-
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Please find below and/or attached an Office communication concerning this application or proceeding.

		Application No.	Applicant(s)			
		10/604,907	CHEN ET AL.			
	Office Action Summary	Examiner	Art Unit			
•		Monica Lewis	2822			
The MAILING DATE of this communication appears on the cover sheet with the correspondence address Period for Reply						
A SHO THE N - Exten after S - If the - If NO - Failur Any re	DRTENED STATUTORY PERIOD FOR REPL' MAILING DATE OF THIS COMMUNICATION. sions of time may be available under the provisions of 37 CFR 1.1 SIX (6) MONTHS from the mailing date of this communication. period for reply specified above is less than thirty (30) days, a reply period for reply is specified above, the maximum statutory period e to reply within the set or extended period for reply will, by statute sply received by the Office later than three months after the mailing d patent term adjustment. See 37 CFR 1.704(b).	36(a). In no event, however, may a reply be time within the statutory minimum of thirty (30) days will apply and will expire SIX (6) MONTHS from a cause the application to become ABANDONE!	nely filed s will be considered timely. the mailing date of this communication. O (35 U.S.C. § 133).			
Status		·				
1)⊠	Responsive to communication(s) filed on 26 A	<u>ugust 2003</u> .				
2a)□	This action is <b>FINAL</b> . 2b)⊠ This	action is non-final.				
•	Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i> , 1935 C.D. 11, 453 O.G. 213.					
Disposition	on of Claims					
<ul> <li>4) ☐ Claim(s) 1-38 is/are pending in the application.</li> <li>4a) Of the above claim(s) 29-38 is/are withdrawn from consideration.</li> <li>5) ☐ Claim(s) is/are allowed.</li> <li>6) ☐ Claim(s) 1-28 is/are rejected.</li> <li>7) ☐ Claim(s) is/are objected to.</li> <li>8) ☐ Claim(s) are subject to restriction and/or election requirement.</li> </ul>						
Application	on Papers					
10)[2]	The specification is objected to by the Examine The drawing(s) filed on <u>26 August 2003</u> is/are: Applicant may not request that any objection to the Replacement drawing sheet(s) including the correct The oath or declaration is objected to by the Ex	a) accepted or b) objected of drawing(s) be held in abeyance. See iion is required if the drawing(s) is obj	e 37 CFR 1.85(a). ected to. See 37 CFR 1.121(d).			
Priority u	nder 35 U.S.C. § 119					
<ul> <li>12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).</li> <li>a) All b) Some * c) None of:</li> <li>1. Certified copies of the priority documents have been received.</li> <li>2. Certified copies of the priority documents have been received in Application No</li> <li>3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).</li> <li>* See the attached detailed Office action for a list of the certified copies not received.</li> </ul>						
2) Notice 3) Inform	(s) of References Cited (PTO-892) of Draftsperson's Patent Drawing Review (PTO-948) nation Disclosure Statement(s) (PTO-1449 or PTO/SB/08) No(s)/Mail Date 8/03.	4) Interview Summary Paper No(s)/Mail Da 5) Notice of Informal P 6) Other:				

Application/Control Number: 10/604,907

Art Unit: 2822

### **DETAILED ACTION**

1. This office action is in response to the application filed August 26, 2003.

### Election/Restrictions

- 2. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - Claims 1-28, drawn to a field effect transistor, classified in class 257, subclass 336.
  - II. Claims 29-38, drawn to the method for forming an integrated circuit, classified in class 438, subclass 197.

Inventions II and I are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). The product can be made by a materially different process, for example, a mask could be used instead of a gate to define source/drain areas and then the gate could be formed offer the filling step.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

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Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

During a telephone conversation with Charles Peterson on 7/20/04 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-28. Affirmation of this election must be made by applicant in replying to this Office action. Claims 29-38 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

## Claim Rejections - 35 USC § 103

- 3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
  - (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
- 4. Claims 1-4, 9-15 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (U.S. Publication No. 2004/007724) in view of Xiang et al. (U.S. Patent No. 6,437,404).

In regards to claims 1 and 18, Murthy et al. ("Murthy") discloses the following:

- a) a thin channel (36) having a first thickness (For Example: See Figure 7 and Paragraph 34);
  - b) a gate (22) disposed above said thin channel (For Example: See Figure 7); and
- c) a source/drain region in a recess at each end of said thin channel (For Example: See Figure 8 and Paragraph 41).

In regards to claims 1 and 18, Murthy fails to disclose the following:

a) source and drain substantially thicker than said thin channel.

However, Xiang et al. ("Xiang") discloses the use of a source and drain substantially thicker than said thin channel (For Example: See Figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a source and drain substantially thicker than said thin channel as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

b) a source/drain extension between said thin channel and a corresponding said source/drain region, each said source/drain extension and said corresponding source/drain region being aligned to said gate and said thin channel.

However, Xiang discloses the use of a source and drain extensions (For Example: See Figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a source and drain extensions as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

In regards to claims 2 and 19, Murthy discloses the following:

a) recess extends under said gate at said each end (For Example: See Figure 7).

In regards to claims 3 and 20, Murthy discloses the following:

a) recess partially extends under said gate at said each end (For Example: See Figure 7).

In regards to claim 4, Murthy fails to disclose the following:

a) an upper surface of each said source/drain region is substantially coplanar with an upper surface of said thin channel.

However, Xiang discloses the use of a source and drain that is substantially coplanar with an upper surface of said thin channel (For Example: See Figure 1). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a source and drain that is substantially coplanar with an upper surface of said thin channel as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

In regards to claim 9, Murthy fails to disclose the following:

a) thin channel is smaller than 15 nm thick.

However, Xiang discloses the use of a thin channel that is smaller than 15 nm thick (For Example: See Column 4 Lines 16-20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a thin channel that is smaller than 15 nm as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

Finally, the applicant has not established the critical nature of a "thin channel is smaller than 15 nm thick." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 10, Murthy fails to disclose the following:

a) thin channel is 10 nm thick.

However, Xiang discloses the use of a thin channel that is smaller than 10 nm thick (For Example: See Column 4 Lines 16-20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a thin channel that is smaller than 10 nm as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

Finally, the applicant has not established the critical nature of a "thin channel is 10 nm thick." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*,

919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 11, Murthy discloses the following:

a) thin channel is smaller than 40 nm long.

However, Xiang discloses the use of a thin channel that is smaller than 40 nm thick (For Example: See Column 4 Lines 16-20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a thin channel that is smaller than 40 nm as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

Finally, the applicant has not established the critical nature of a "thin channel is smaller than 40 nm long." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 12, Xiang discloses the following:

a) thin channel is 30 nm long.

However, Xiang discloses the use of a thin channel that is 30 nm long (For Example: See Column 4 Lines 16-20). It would have been obvious to one having ordinary skill in the art at the

time the invention was made to modify the semiconductor of Murthy to include the use of a thin channel that is 30 nm long as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

Finally, the applicant has not established the critical nature of a "thin channel is 30 nm" long." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 13, Murthy fails to disclose the following:

a) a lower surface of said recess is greater than 5nm below said thin channel.

Additionally, the applicant has not established the critical nature of "a lower surface of said recess is greater than 5nm below said thin channel." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 14, Murthy fails to disclose the following:

a) lower surface is 40 nm below said thin channel.

Additionally, the applicant has not established the critical nature of a "lower surface is 40 nm below said thin channel." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 15, Murthy discloses the following:

- a) FET is disposed on an insulating layer (18) and said insulating layer is disposed on a semiconductor substrate (For Example: See Figure 7).
- 5. Claims 5, 7, 16 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (U.S. Publication No. 2004/007724) in view of Xiang et al. (U.S. Patent No. 6,437,404) and Yu (U.S. Patent No. 6,743,680).

In regards to claims 5 and 21, Murthy fails to disclose the following:

a) thin channel is a semiconductor material selected from a group consisting of silicon (Si), Germanium (Ge), SiGe and strained silicon (SSi).

However, Yu discloses the use of a SiGe channel (For Example: See Column 4 Lines 20-33). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a SiGe channel as disclosed in Yu because it aids in increasing charge carrier mobility (For Example: See Column 4 Lines 20-33).

Additionally, since Murthy and Yu are both from the same field of endeavor, the purpose disclosed by Yu would have been recognized in the pertinent art of Murthy.

Finally, the following limitation makes it a product by process claim: a) "strained silicon (SSi)." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao and Sato et al., 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also In re Brown and Saffer, 173 USPQ 685 (CCPA 1972): In re Luck and Gainer, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and In re Marosi et al., 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a "product by, all of" claim, and not the patentability of the process, and that an old or obvious product, whether claimed in "product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 7, Murthy discloses the following:

a) gate is made from a material comprising polysilicon (For Example: See Paragraph 25).

In regards to claim 16, Murthy fails to disclose the following:

a) semiconductor substrate comprises a silicon substrate.

However, Yu discloses the use of a silicon substrate (For Example: See Column 3 Lines 3-5). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a silicon substrate as disclosed in Yu because it aids in the formation of a device that has improved mobility (For Example: See Column 2 Lines 22-45).

Additionally, since Murthy and Yu are both from the same field of endeavor, the purpose disclosed by Yu would have been recognized in the pertinent art of Murthy.

6. Claims 6 and 22-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murthy et al. (U.S. Publication No. 2004/007724) in view of Xiang et al. (U.S. Patent No. 6,437,404) and Yu (U.S. Patent No. 6,743,680) and *Microchip Fabrication* by Van Zant.

In regards to claims 6 and 23, Murthy fails to disclose the following:

a) thin channel is strained silicon (SSi).

However, Van Zant discloses the use of silicon (For Example: See Page 37). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a silicon as disclosed in Van Zant because it aids in allowing high temperature processing (For Example: See Page 37).

Additionally, since Murthy and Van Zant are both from the same field of endeavor, the purpose disclosed by Van Zant would have been recognized in the pertinent art of Murthy.

Finally, the following limitation makes it a product by process claim: a) "strained silicon (SSi)." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in

product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

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A "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao and Sato et al., 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also In re Brown and Saffer, 173 USPQ 685 (CCPA 1972): In re Luck and Gainer, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and In re Marosi et al., 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a "product by, all of" claim, and not the patentability of the process, and that an old or obvious product, whether claimed in "product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 22, Murthy discloses the following:

a) gate is made from a material comprising polysilicon (For Example See Paragraph 25).

In regards to claim 22, Murthy fails to disclose the following:

a) thin channel is silicon.

However, Van Zant discloses the use of silicon (For Example: See Page 37). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a silicon as disclosed in Van Zant because it aids in allowing high temperature processing (For Example: See Page 37).

Additionally, since Murthy and Van Zant are both from the same field of endeavor, the purpose disclosed by Van Zant would have been recognized in the pertinent art of Murthy.

In regards to claim 24, Murthy fails to disclose the following:

a) thin channel is smaller than 15 nm thick.

However, Xiang discloses the use of a thin channel that is smaller than 15 nm thick (For Example: See Column 4 Lines 16-20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a thin channel that is smaller than 15 nm as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

Finally, the applicant has not established the critical nature of a "thin channel is smaller than 15 nm thick." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 25, Murthy fails to disclose the following:

a) a lower surface of said recess is greater than 5nm below said thin channel.

Additionally, the applicant has not established the critical nature of "a lower surface of said recess is greater than 5nm below said thin channel." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is

critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claim 26, Murthy discloses the following:

a) thin channel is smaller than 40 nm long.

However, Xiang discloses the use of a thin channel that is smaller than 40 nm thick (For Example: See Column 4 Lines 16-20). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a thin channel that is smaller than 40 nm as disclosed in Xiang because it aids in reducing high parasitic resistance (For Example: See Column 1 Lines 5-57).

Additionally, since Murthy and Xiang are both from the same field of endeavor, the purpose disclosed by Xiang would have been recognized in the pertinent art of Murthy.

7. Claims 17, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xiang et al. (U.S. Patent No. 6,437,404) in view of Boyd et al. (U.S. Patent No. 6,271,094).

In regards to claims 17 and 28, Murthy fails to disclose the following:

a) semiconductor substrate comprises a strained silicon/silicon germanium (SSi/SiGe) substrate.

However, Boyd et al. ("Boyd") discloses the use of a silicon/silicon germanium (SSi/SiGe) substrate (For Example: See Column 4 Lines 50-57). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a Si/SiGe substrate as disclosed in Boyd because

it aids in providing a reliable device (For Example: See Column 1 Lines 55-67 and Column 2 Lines 1-39).

Additionally, since Murthy and Boyd are both from the same field of endeavor, the purpose disclosed by Boyd would have been recognized in the pertinent art of Murthy.

In regards to claim 27, Xiang fails to disclose the following:

a) semiconductor substrate is a silicon substrate.

However, Boyd discloses the use of a silicon substrate (For Example: See Column 4 Lines 50-57). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Murthy to include the use of a silicon substrate as disclosed in Boyd because it aids in providing a reliable device (For Example: See Column 1 Lines 55-67 and Column 2 Lines 1-39).

Additionally, since Murthy and Boyd are both from the same field of endeavor, the purpose disclosed by Boyd would have been recognized in the pertinent art of Murthy.

#### Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 571-272-1838.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7722 for regular and after final

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communications. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956

ML

September 10, 2004

Mary Wilczewski Primary Examiner Page 16